

MEDICAL OFFICERS OF SCHOOLS
ASSOCIATION

The
Control of Measles

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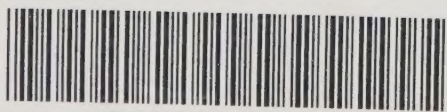
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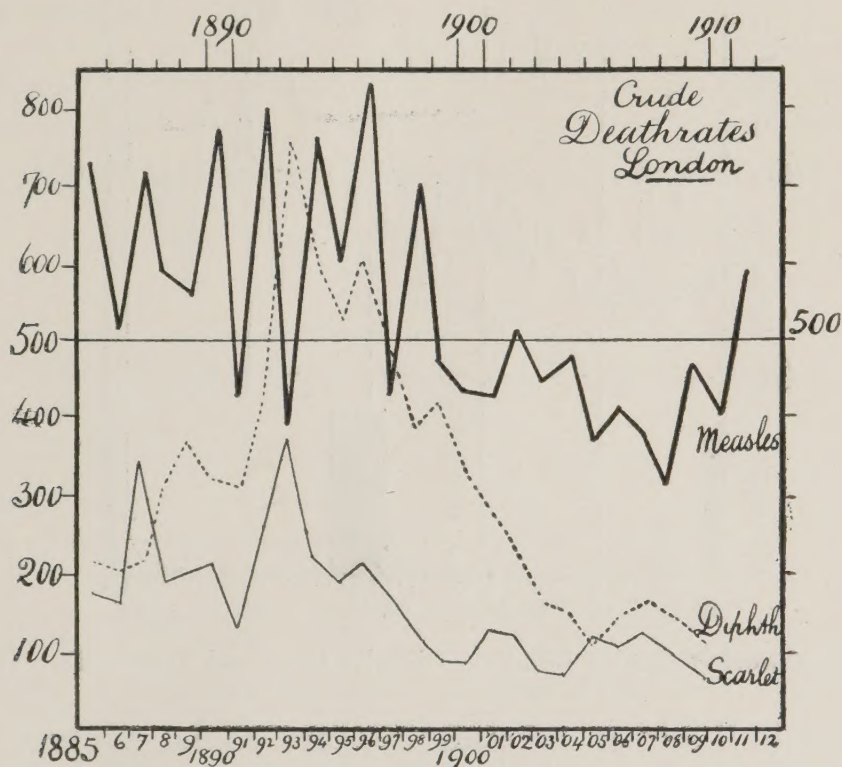
The Control of Measles.

I.—By JAMES KERR, M.A., M.D., D.P.H.*

The three most important zymotic diseases as regards the elementary schools are measles, scarlatina and diphtheria. Of these the most elusive is measles.

Examining their death-rates as set out in Fig. 1, which shows

FIG. 1.



Crude death-rates London. Measles, scarlet fever, diphtheria.

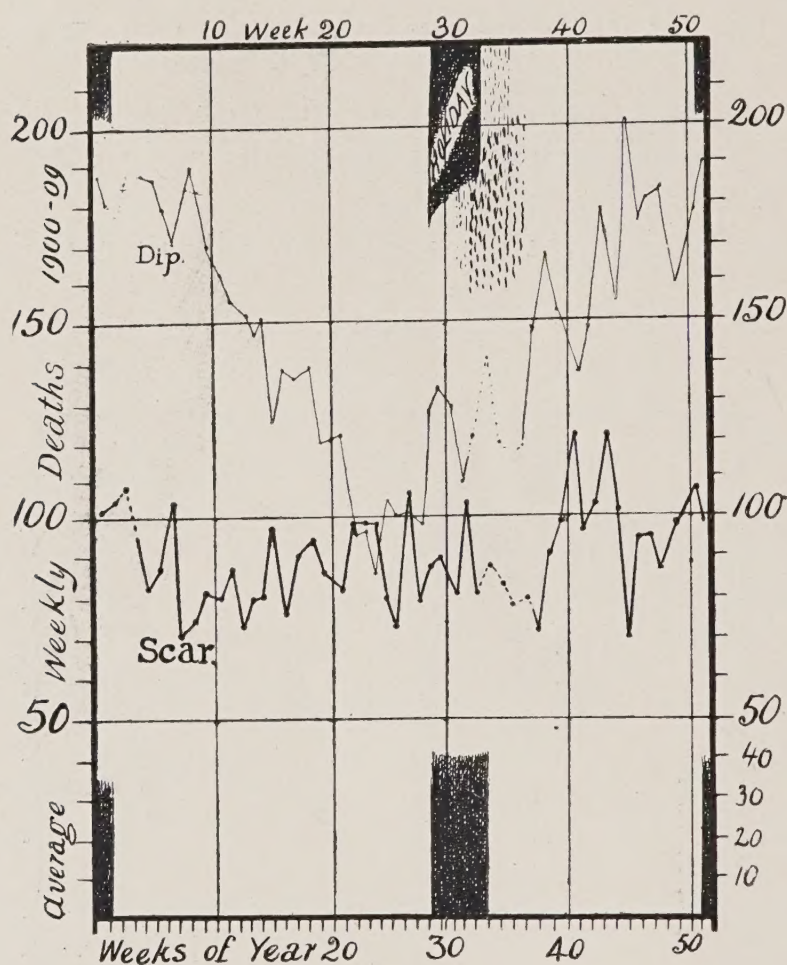
the crude death-rates in London for the past quarter century, a steady fall is seen recently in the scarlatinal and diphtheritic rates, and a proportionately much less reduction in those for measles.

Diphtheria, indeed, had become almost unknown when it broke out with epidemic virulence in the south-eastern counties in 1857, and in Fig. 1 it is seen to have increased greatly in violence in the half dozen years preceding 1893. It was in

* Meeting of the Medical Officers of Schools Association, May 9th, 1913.

accounting for this increase that school attendance was first postulated as a material factor, and the weekly statistics of scarlatina and diphtheria notifications brought forward as furnishing evidence in the so-called holiday influence. Scarlatina and diphtheria differ from measles in this respect—that when properly examined the evidence is against school attendance in towns being a significant factor in their

FIG. 2.



Ten years' weekly deaths, London.—Scarlet fever and diphtheria. Holiday.

dissemination, whilst measles appears to be subject to considerable spread through school outbursts.

The weekly mortality curves in London for scarlatina and diphtheria which are summed for ten years in Fig. 2 show in the dotted part of the curves, which is that subject to holiday influence, that there is no significant or distinctive effect.

The only reason for mentioning this hypothesis is that the case of scarlatina and diphtheria may serve as a warning not to attach too much importance to school attendance in towns as a means of spread of measles.

Influences are revealed in these curves, which have a preponderating effect in determining the results of the diseases,

but they are factors which have not yet been comprehended. These unanalysed factors also show up otherwise than in the long secular waves of epidemicity, for there are wide geographical and national variations to be found in the returns provided by the Registrar-General from other lands. The tables in Fig. 3, to take one instance, show that whilst Prussia has had less measles mortality, it has had three and a half times the diph-

FIG. 3.

Death rates per million living (1887—1908)

	<i>United Kingdom</i>	<i>France</i>	<i>Prussia</i>	<i>Austria</i>	<i>Belgium</i>	<i>Holland</i>	<i>USA</i>
<i>Measles</i>	354	810	260	382	457	258	101
<i>Scarlatina</i>	135	171	275	511	158	31	104
<i>Diphtheria</i>	199	864	750	788	315	127	87
<i>Tubercular Consumption</i>	1425	—	2160	3470	1368	1608	12627

In the case of the United Kingdom a further analysis can be made

	<i>United Kingdom</i>	<i>England and Wales</i>	<i>Scotland</i>	<i>Ireland</i>
<i>Measles</i>	354	386	413	168
<i>Scarlatina</i>	135	149	141	71
<i>Diphtheria</i>	199	228	177	81
<i>Tubercular Consumption</i>	1425	1343	1780	2165

Deaths per million. Foreign countries.

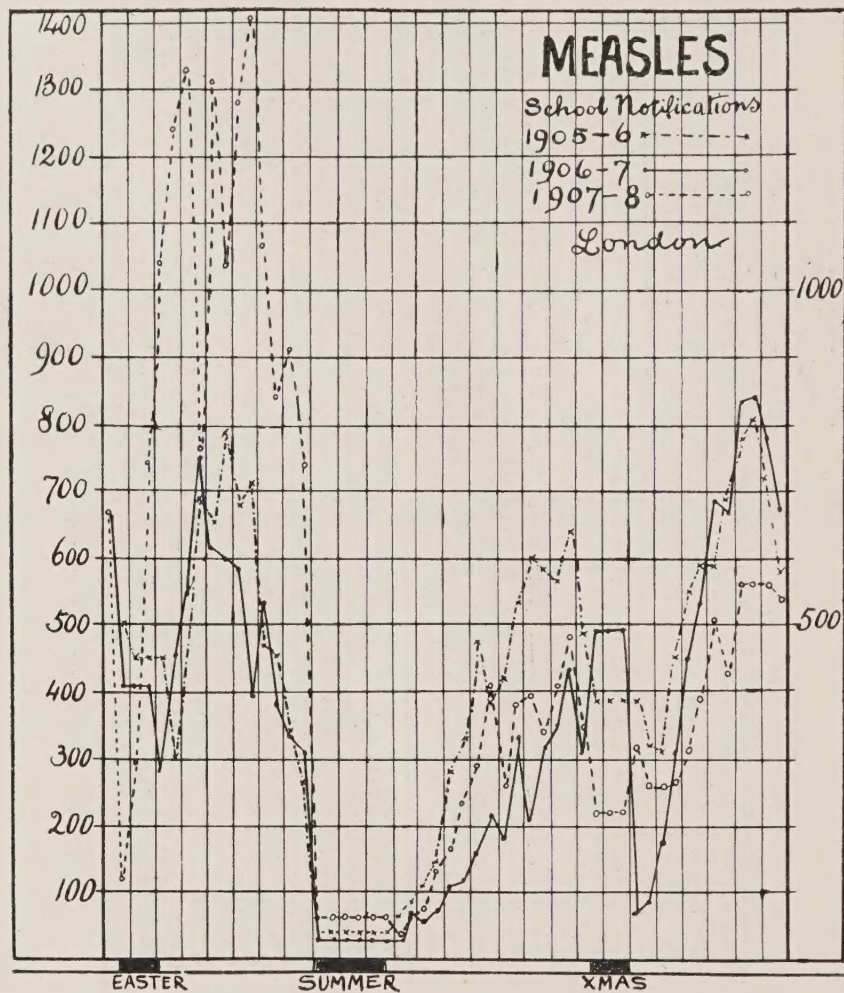
theria mortality of the United Kingdom. So, too, Scotland, fairly comparable with England in other respects, with a nearly equal birth-rate, shows a greater measles mortality, although the average age of commencing school is nearly a year older in Scotland.

The prevalence of measles judged from school notifications follows a regular seasonal course, as set out for three successive years in Fig. 4. In examining these the absence of notifications during holidays has to be remembered, but the diminution of notifications for some time after both Easter and Christmas as well as the summer vacation is noticeable. It may be evidence of a certain temporary amount of holiday effect. The factor of

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the school teacher and attendance officer as detectors of disease at one time in action, and at vacations out of action, can be eliminated by turning to records of deaths. In Fig. 5, which is adapted from a paper in *School Hygiene*, the weekly mortality* for ten years smoothed out in three-weekly averages by Dr. Fairfield shows remarkably the absence of holiday effect in diphtheria and scarlatina. This is especially noteworthy in the

FIG. 4.



Measles, school notifications weekly (3 years).

Christmas vacation, where diphtheria deaths are occurring at double the rate of the summer, and where, if it existed, such effect ought to be most marked. Both these holidays show up as depressions in the measles mortality curves.

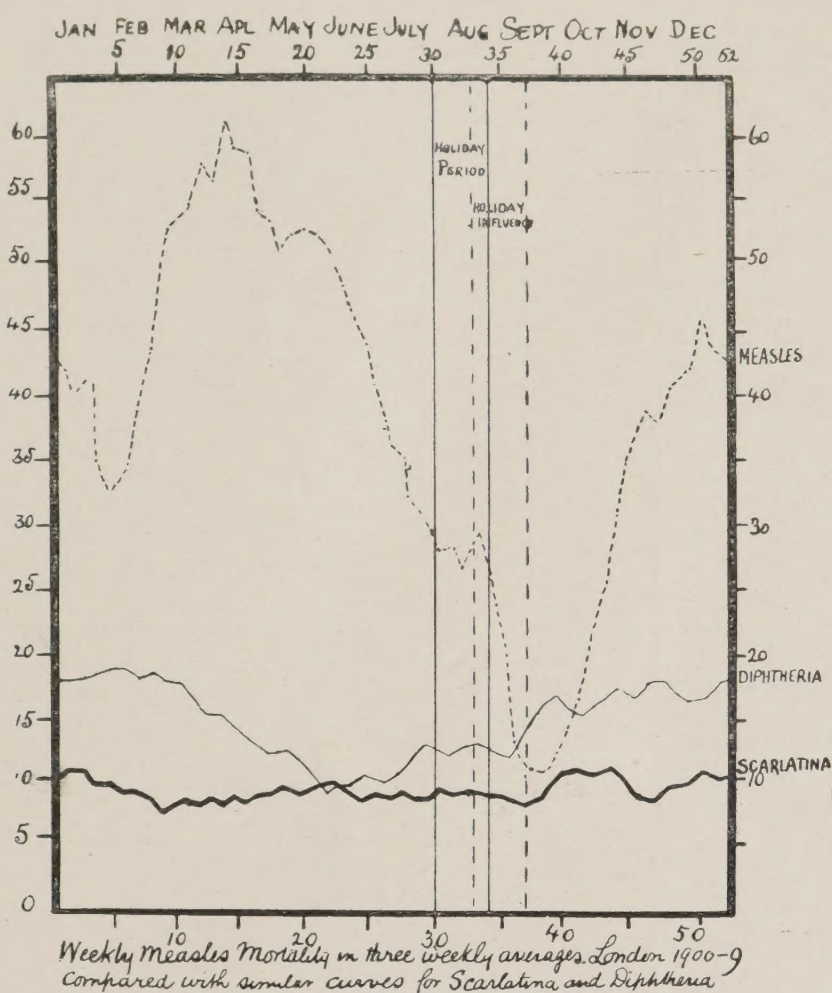
Turning to the form of school outbreak the returns show the appearance of measles almost confined for a time to one class, then extending to another, anything from six to a dozen children in one class being absent without another case in school.† On the other hand, scarlatina appears quite differently. It is the exception to find more than a couple of cases in one

* *School Hygiene*, vol. ii, 1911, p. 549.

† See tables, pages 136, 137.

class without other classes being affected. The usual course is to have the first four or five cases scattered in at least three or four classes, almost simultaneously. With very strenuous efforts to prevent measles cases, the form of outbreak tends to become like that of scarlatina as the element of school contagion becomes repressed. Formerly the practice in measles outbreaks was to close schools when a certain percentage of

FIG. 5.



Ten years' weekly deaths, three weeks' averages, measles, scarlet fever, diphtheria.

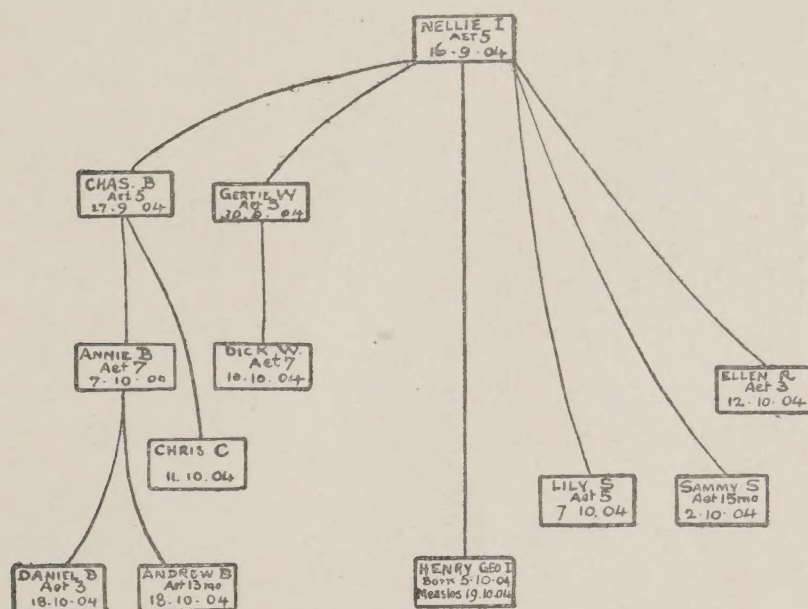
loss of attendance was reached. This practice appeared to stop the outbreak. Tracing the natural history of such an outbreak, however, the efficiency of the method soon became doubtful. When a few cases had been noticed many others would obviously be infected and incubating the disease.

In one school of 450 children, 170 being classed as infants, there had been 15 cases of measles during the month of April. At the end of April the school was closed by authority for a month. On re-opening it was ascertained that 24 cases had occurred within the month of closure; and of the other children 118 developed measles within five days of the re-open-

September 16th; before she was isolated she played with her cousin, Charles B—, aged 5 years, and her bosom friend, Gertie W—, also aged 5 years. These two children contracted measles from her. Charles B— affected the rest of his family, three in number, through his sister Annie B—, and also gave it to his chum and next-door neighbour, Chris C—, who failed on October 11th.

Gertie W— imparted it to her brother Dick W—. Nellie I—'s mother was expecting an addition to the family, so since Nellie's attack was only slight after a week of isolation she was early allowed out of doors, and called on her other friend,

FIG. 8.



Nellie I— and her circle.

Lily S—, whom she assisted in caring for the baby, Sammy S—. Both Lily and Sammy took the disease. All her five-year-old friends having now succumbed, she played with a three-year-old, Ellen R—, who also got measles. Three weeks after Nellie's illness, Henry George I— was born, and when two days old Nellie was permitted to see him. Fourteen days later he began with measles, from which he fortunately recovered. Nellie thus was known to have directly infected eleven cases out of school.

On the other hand, a girl of five attended school. She came from a guardian's home, to which she had only been admitted a few days before, and was first noticed actually ill at school. Early action was taken, and yet she was known to be the cause of 207 cases, necessitating fourteen class closures in four schools, and leading to the district becoming practically infected.

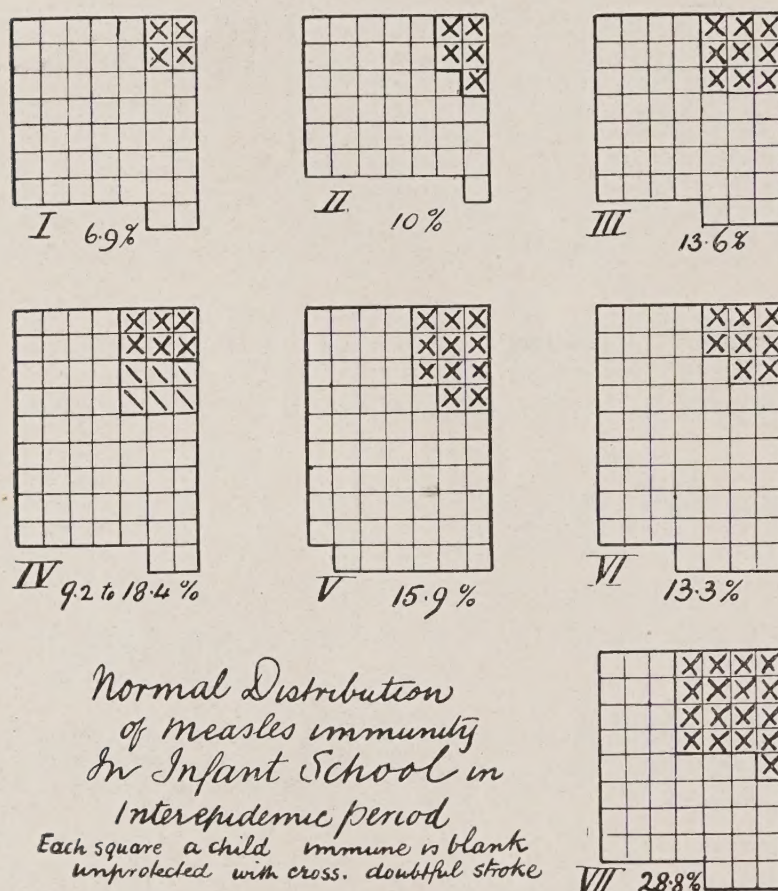
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The earliest studies of school immunity showed that the spread of measles depended on the age of the children in the class, as the immunity was proportionate to age, the younger children suffering the most frequently.

This has been mapped out for an average infant school in Fig. 9.

A picture of a school outbreak and its usual course having

FIG. 9.



Measles immunity in infant school.

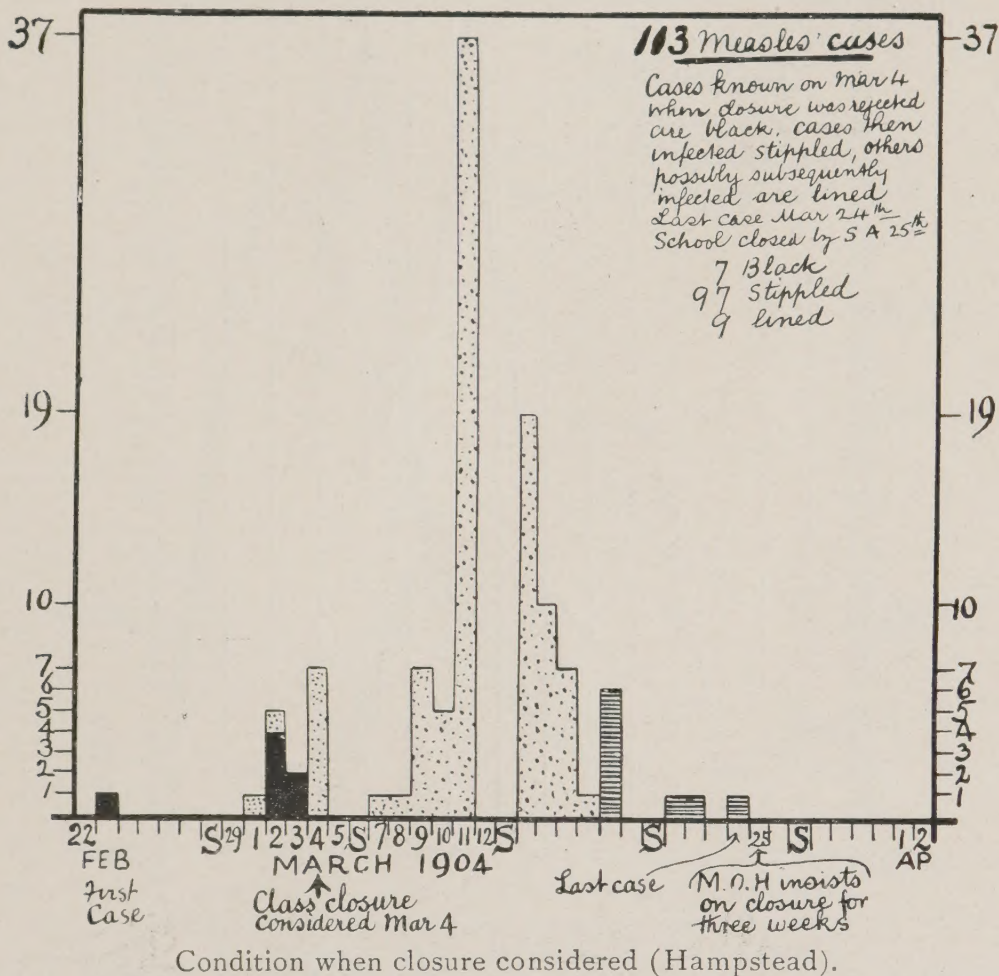
been thus built up, it was possible to see where school or class closure might do good, and where it would be hopeless.

In Fig. 10 are represented events in an outbreak of 113 cases, which, although noted at the time, were not published for some years subsequently. A single case occurred on February 23rd. It was notified with six more nine days later. The question of class closure was considered, and rejected as it was concluded that all who were likely to get the disease would now be infected. The number who showed the disease within a fortnight was ninety-seven, and subsequently ten more cases were noted, the last of which failed on March 24th, when the outbreak came to an end. The medical officer of health on the following day insisted on closure for three weeks. There

was, however, no further case recorded, and the closure was quite unnecessary.

By watching the first cases, and where non-immune material exists in the class by exclusions from the ninth to the fourteenth day, it is often possible to catch the first crop. The more successfully this is done the oftener it becomes necessary. It is also more successful if the parents are specially warned to look out for the commencing symptoms of disease in order to isolate the children early. Ultimately, by such success much

FIG. 10.

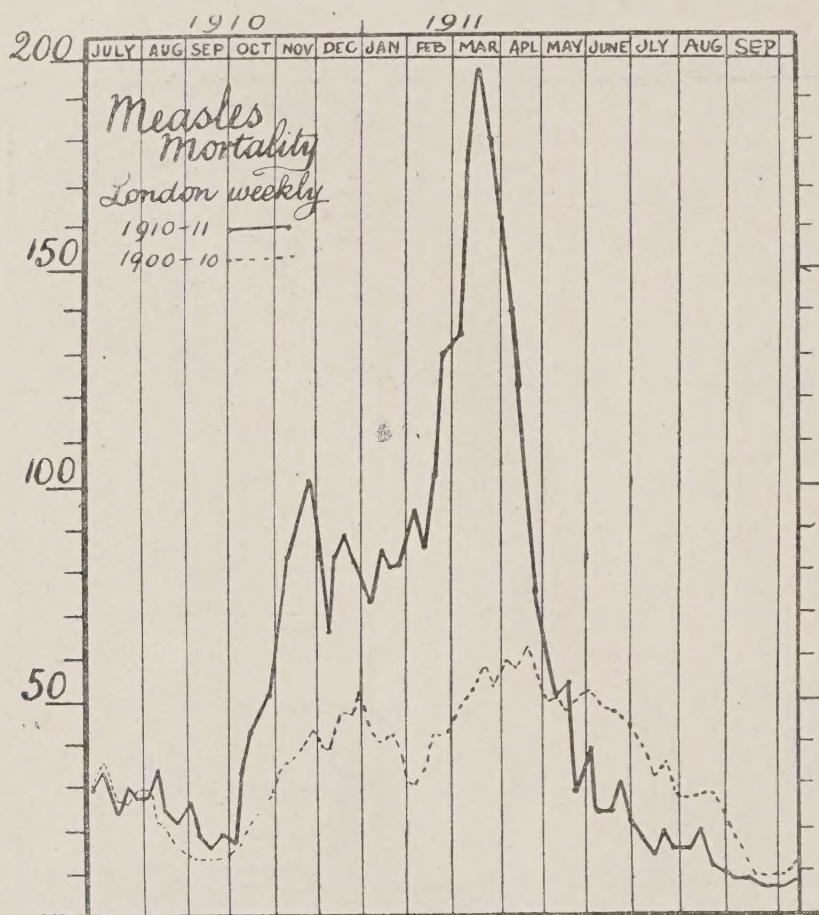


material may be expected to be heaped up which one day will attain an explosive extent. There will be alarm, much wild talk, and all will be forgotten till the next outbreak. Two years ago there was such a clearance in London, when as a result the accumulation of non-immune children fell to 18 per cent. in the schools. The dictum laid down by Dr. Thomas as a result of his Woolwich studies, that if 30 per cent. had not had measles it would spread until only 15 per cent. remained unaffected, is in accord with Dr. Shelley's observations earlier at the International Congress of Hygiene and Demography in London.

The weekly mortality curve for such an epidemic outbreak in the winter of 1910-11 is shown in Fig. 11, with the dotted curve for ten years. Much as it frightened all kinds of people, this epidemic is not up to the death-rates which occurred every alternate year of the nineties, as shown in the first figure.

Mortality rates are used because they must be nearest the truth. Case notifications of measles are not worth much. In

FIG. 11.



Mortality weekly London decennum and epidemic.

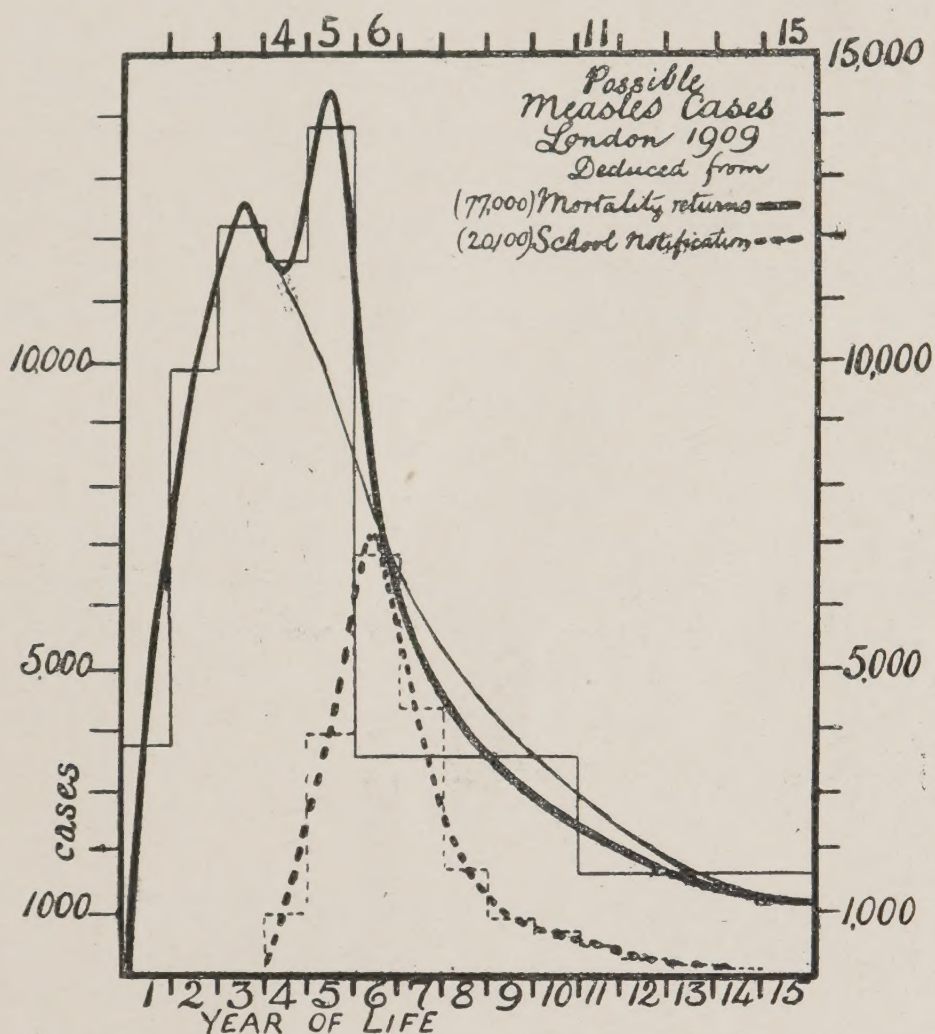
any family, unless a sufferer dies or there is a school child, measles never comes to official cognisance.

The number of cases that actually occur can be roughly reconstructed from the mortality returns. Recurrent cases are rare. One attack gives great protection. At Aberdeen, where 24,256 cases were recorded in 1893-1902, only 2.46 per cent. were supposed to be second, and 0.05 per cent. third attacks. The Aberdeen mortality was 3.3 per cent., Edinburgh 3.5 per cent., St. Helens 3.3 per cent. Taking 3.3 per cent. as the ratio of mortality, and preserving the mortality ratios at the various age-groups, on the basis of the Aberdeen, Edinburgh and St. Helens records, Fig. 12 gives an attempt to reconstruct the actual course of measles events in London in 1909. The

thick black curve with the hump at the fifth year of age gives the probable effect of school attendance. The thin continuous line is an indication of what events might be expected to follow if school influence could be eliminated. The thick dotted line is the actual knowledge derived from school notifications.

The social condition, which in the higher ranks means better care for children, and also that the orbit of the child is restricted

FIG. 12.



Theoretical reconstruction of London measles, 1909.

to its own family, or at least a very small range, till the age of seven or eight, is such that the average age of measles there occurs about seven or eight, whilst the average age among the working classes is probably under five. The younger the child, and the younger the family, the higher the mortality is likely to be. This is the explanation of the vastly different mortalities published for cases in one-, two- or three-roomed houses. It has been demonstrated in carefully regulated institutions that, like other infectious diseases, children with measles can be nursed in the same wards with other susceptible children with-

out the latter running serious risk of infection, if strict aseptic precautions are observed.

It would probably not be a loss in the public health sense if all children could pass through measles by the age of seven. The difference between the poorer and wealthier classes in regard to age-incidence shows that social condition is the main factor in spread. No hope can be held out of permanently and materially affecting measles mortality in London by school closure. The comparatively slight effect of school endeavours on measles makes it probable that much of the supposed school spread is apparent, not real. In any case, school spread is not serious, and the spread among younger children in towns would go on as before, even if schools were closed. There would probably be a few months' depression in the curve, and then a very slight permanent change. The incidence of this disease must be generally attacked by other means, such as compulsory (parental) notification, some hospital isolation for bad cases, education of parents as to means of treating the disease, and probably also the adoption of more scientific (aseptic) treatment of actual cases and especially improvement in regard to habits of life, housing and space to live. As regards special measures, no marked improvement is to be expected from any fresh school regulations, and definite changes may only be looked for when population becomes less congested or some new prophylactic or therapeutic method is introduced.

II.—By L. R. LEMPRIÈRE, M.B.,

Resident Medical Officer, Haileybury College.

I will try very briefly to give my opinions based on ten years experience as Resident Medical Officer to Haileybury College, a public school of 500 boys, and my remarks must be taken as referring to public schools only.

I will begin by stating two propositions :

(1) The control of measles is non-existent : that is, given one case of measles, an epidemic will inevitably follow ; it is true sporadic cases have been reported, but they are so rare that for all practicable purposes they may be neglected.

(2) My second proposition is this : that if it were possible to control the spread of measles, it would not be in the best interests of the community to do so ; I admit that so far I have

not had the courage of my opinion on this point and still attempt quarantine and isolation.

Epidemics undoubtedly differ in their severity, but generally speaking, the bigger the epidemic, the more numerous and severe are the complications, and it follows that if further scope were given to this disease in younger and smaller communities, such as the private schools, severe or fatal complications would be fewer.

Measles in a community of 40 to 60 boys of ages between 9 and 13 is much less serious than in a community of 500 whose ages lie between 13 and 19. But it is Utopian to hope that private schools will welcome this suggestion, hinted at, with open arms.

Given a case of measles, then, I look upon an epidemic as inevitable. Koplik's spots are useless except for diagnosis. Meunier's sign is impracticable, and I am convinced that infection is present before the initial coryza or cough. What steps, then, are to be taken? Notification to the parents allowing, though not advising them to take the unprotected boys home, is, I think, sound, and is adopted at one public school, though, I believe, with slight effect.

In general we want to know what proportion will be attacked, and what and when will be the maximum number affected at one time. Dr. Armstrong, of Wellington, has a valuable series of curves based on a long experience, but it is only empirical; it may be stated that the larger the number of unprotected, the more relatively will be affected and the quicker the epidemic will be over.

For example, given 100 unprotected, 85 will probably be attacked, and the maximum number, 75, will be reached at the end of the fourth week; in our epidemic of last term 112 out of 125 unprotected were attacked, and the largest number of beds occupied were 109 on the thirtieth day. Second only in importance to the provision of beds, which necessitates the emptying of dormitories or houses, is floor space, and for this we have to take what we have, and in most of our public schools I imagine the ideal provision of 144 square feet is far beyond the actuality.

In my own school, where measles were nursed in the sanatorium 64 beds and a dormitory of 48 beds, the average was 80 square feet in the latter and rather less in the former.

This I admit to be quite inadequate, and is the greatest practical difficulty we have to contend with, but it must exist, so long as we have fewer and larger outbreaks instead of more and smaller ones.

One can—and this is most important—in the early days utilise this space to the best advantage by scattering all the early cases into separate wards and adding fresh cases to each ward in turn, or in a dormitory by leaving out cubicles as far as possible; this entails much extra nursing and ward help, but any attempt at economy in this direction is courting disaster.

I find that I had twenty-three nurses working at the height of our epidemic, about an average of five to a nurse, and so long as we treat our patients on the only safe and rational lines, and keep them in bed for at least twelve days, including the use of that bugbear to the school boy, the bed-pan, some such proportion is absolutely essential. There are two other points:

(1) Does a previous attack confer immunity? Yes, to a very large extent, say 95 per cent., and this proportion would be increased if there were fewer mistakes in diagnosis. I believe Koplik is absolutely pathognomonic, and that the spots are *always* present. I have never failed to find them.

(2) Is disinfection necessary after an attack? Certainly not if the boy returns to school, but advisable to calm domestic fears if he goes home.

I would conclude by saying, in my opinion, the tendency has been towards over-legislation and prevention, which have failed, at the cost of an enormous waste of time, loss of work, and expense, and I am glad to see there are signs of a reaction in the last issue of the code of regulations by our Association.

My views may sound pessimistic and reactionary, but looked squarely in the face, I believe they are sound, though not yet acceptable to the British mother.

III.—By REGINALD DUDFIELD, M.A., M.B., D.P.H.

Many medical officers of health hold that it is useless to attempt to exercise any control over the spread of measles, and that no beneficial results have followed the attempts made in that direction from time to time in the past. The paper read by Dr. Butler in February last before the Epidemiological Section of the Royal Society of Medicine appears to have been written in that frame of mind. Dr. Butler says in his concluding paragraph:

“The control of measles, so far as one can judge from a broad survey of the facts, is likely to be successfully effected

when a vaccine has been discovered, analogous to the vaccine which, where it has been efficiently used, has banished small-pox. Until this has been done it would seem that measles must play its time-honoured *rôle* and visit in continually recurring epidemics the successive generations of men, who in this natural but sacrificial manner, acquire the protective immunity which enables the greater mass of the population to withstand the otherwise ever-present presage of a pandemic disease."

It seems to me that such a fatalistic *non possumus* attitude is an inconsistency for a medical officer of health, whose function is prevention of disease. If he fails with one method he must devise another, and keep on doing so until he achieves success. There should be no folding of the hands until someone invents the wished-for vaccine.*

The medical officer of health, who is anxious to do something towards controlling the disease, has to take into account certain difficulties not met with in his work in connection with other infectious diseases. The first difficulty is associated with the onset of the disease, which is not characterised by symptoms which at once raise suspicions as to the true nature of the malady, but simulate the common cold. Whilst the prodromal symptoms are developing the infectivity of the disease is at its highest. The infallible guides which various observers have put forward prove to be most unreliable in every-day practice. His next difficulty lies in the fatalism of the general public, who have made up their minds that every child must have the disease in childhood, and are of opinion that the sooner the bother is over the better—for the comfort of the parents, but very doubtfully so for the child. Hence, it is only too often exceedingly difficult to induce parents to take any precautions against the spread of infection, many preferring deliberately to put the children in the way of becoming infected. The public fail to realise the dangers attaching to the disease, both in the form of fatality to the very young and in that of the sequelæ which may arise in later life.

For the past fifteen years I have been trying to keep some control over the disease. My experience has been limited to the conditions to be found in a large metropolitan district containing a fair proportion of well-to-do inhabitants. Among such people the disease, while not without its dangers, is of a

* Dr. Butler's "practice" as Medical Officer of Health of Willesden was just the opposite of what might have been expected from the remarks quoted above. He was most active in his efforts to control the disease.

comparatively trifling importance, good medical treatment and nursing being available. In the poorer parts the story is quite the reverse, and having in mind the relatively high fatality in very young children and the frequency of complications, of which broncho-pneumonia is perhaps the commonest in neglected cases, there appeared to me to be no alternative but to take up the work. In a metropolitan district there is one special factor in the spread of the disease to which I attach considerable importance. I refer to the aggregation of young children, often as young as three years old, in the infants' departments of the public elementary schools. Dr. Thomas, in speaking to Dr. Butler's paper, observed that "he was not at all convinced that the public elementary schools played such an evil part in measles as was generally attributed to them." Later on he described the aggregation of susceptible children in the schools as the "sweeping into little heaps" of the "gunpowder" representing such children. Naturally when a child attends a school in an infectious state the "little heaps" will touch-off, so that I think the second of the quoted remarks rather contradicts the first. Personally I feel convinced that the public elementary schools occupy a very important position with reference to the control of the disease.

The usual machinery for the prevention of the spread of infectious diseases comprises notification, isolation and disinfection. It is necessary to examine each of those methods to see how it can be adapted to the special case of measles.

Notification.—Obviously a knowledge of the existence of the disease is the first essential to any scheme for its control. At present I have to depend upon the information supplied by the teachers of the public elementary schools, which is of necessity incomplete and is not available during holidays. I have long wanted to have the disease notified by the profession, but until 1911 the Local Government Board declined to entertain proposals from individual metropolitan authorities to extend the notification provisions of the Public Health (London) Act, 1891, to the disease. In that year the Board agreed to the disease being made notifiable for a limited term in Stepney.

Notification of measles has been in force in various districts throughout the country from time to time. It is usually alleged that the information to be obtained by that procedure is very incomplete because medical advice is not sought in the majority of cases—an allegation which my own experience does not confirm. Even if it be admitted that notification by the profession would be incomplete, the information it would afford

would supplement that furnished by the reports from the teachers, and it would, moreover, make good the hiatus caused by the holidays. Further, it is to be expected that a relatively larger proportion of cases among the well-to-do would be notified, which would furnish information about the cases which do not come to the knowledge of the school-teachers.*

The information received from the school-teachers is only too often received too late to afford an opportunity of taking the action desired with a view to checking the spread of the disease. The teachers are not to be blamed for this, as they have to rely on the statements of the parents, who frequently neglect to inform the teachers and even wilfully mislead them.

I want to have notification by the profession, supplemented by systematic reporting by the school-teachers. Notification by the profession might be limited, solely on the score of expense, to the first case in a household or family, but I am not certain whether such limitation might not lead to a certain amount of non-notification.

Before leaving this part of the subject it should be mentioned that it has been stated that notification has proved to be not only costly but useless. As regards costliness the suggested limitation to first cases would provide some relief, and as regards uselessness, I would only say—and I hope that I am not doing anyone an injustice in making the statement—that from such information as I have obtained from reports and other publications, I am doubtful whether the fullest possible use has been made of the information obtained by notification. I mean that I am not sure whether every reported case has been carefully followed up and the utmost use made of the other machinery available.

Isolation.—By this term I mean something more than “isolation” in hospitals or home. What I have to submit is a scheme on a wider basis than that applied in the case of (say) scarlet fever.

The disease being highly infectious when the initial symptoms set in—at a time when diagnosis can be little better than a guess—it is inevitable that in the majority of instances the patient will get into contact with other susceptible individuals. Were it possible to trace all such individuals and to quarantine

* The symptoms of a clear case of measles are so well known to the public that lay notification by parents ought to be insisted on by the Courts, even when no medical practitioner has been called in.

them for a short period—beginning some three days before the onset of the expected illness—the spread of the disease by the first patient would be reduced to a minimum. Such tracing is, however, impossible except in two special cases, viz. the patient's family and the patient's school, if he be of school age. Inasmuch as the clauses of the Public Health Acts relating to the prevention of infectious diseases apply to measles—outside London by reason of the wider drafting of the Public Health Act, 1875, and in London by virtue of the Order made by the County Council in 1904—it should be comparatively easy, given knowledge of a "first case" through notification, to compel the patient's family to take measures to prevent further spread of the disease by the persons infected through contact with the first patient. As regards the school, *closure* of the class-room for a period of a week, of which the fourteenth day from the onset of the first attack should be the central day, and supervision of the families of the patients' class-mates during that week, will, I believe, be efficacious in closing up that channel of spread of the infection. The present practice of the Education Committee of London of excluding only those children who are on the "O/M" Register is unsatisfactory, though good from an educational point of view. My experience tells me that the "M" Register is untrustworthy to a high degree.*

The scheme of isolation embodied in the foregoing paragraph is in effect isolation of the infected family rather than one limited to the patient. It really aims at dealing with the disease in a manner similar to that adopted for bush fires, namely the surrounding of the burning area with a cleared zone over which the flames cannot leap, and leaving the fire to burn itself out within the safety zone. The scheme leaves a number of susceptible individuals to take their chance of being infected by the disease, but that is, I fear, inevitable, having regard to the insidious character of its onset and the associated high infectivity.†

Hospital isolation I consider necessary to provide for the proper treatment of those children whose parents cannot, and occasionally will not, give them that care and attention which

* The causes rendering the "M" Register untrustworthy are mis-statements by parents anxious to secure the admission of their children to school, and the fact of an attack of the disease not conferring complete protection. A fairly large number of second attacks are reported in the course of each epidemic of the disease, occasionally at very short intervals after the first.

† The vaccine to which Dr. Butler alluded would be useful to protect the children exposed to the "chance of infection." I fail to see to what other use such vaccine could be put.

the disease requires. Such form of treatment is the more necessary when the patient is attacked in the colder seasons. I doubt whether hospitals can be expected to do much to prevent the spread of the disease.

Disinfection.—Since 1896 I have consistently urged the need of thorough disinfection being carried out after the disease. As a rule disinfection takes place after the last case in a family has recovered. Until the County Council made the Order already referred to, there was no power to compel disinfection to be done. Now the process is theoretically compulsory, but not absolutely so, because there is no notification by the profession, and hence I can rarely produce medical evidence of any patient having had the disease. In the absence of such evidence no magistrate will inflict a penalty should an attempt be made to take a recalcitrant parent into Court. Fortunately the need of doing so has not arisen so far. On the contrary, requests for disinfection after the disease are becoming more frequent each year. It is through such requests that I hear of many cases, which would otherwise remain unknown to me, in families not sending their children to the public elementary schools.

I am aware that many medical officers of health and medical practitioners regard disinfection as unnecessary, being of opinion that the infective agency of the disease is rapidly destroyed and not carried by fomites. Even at the risk of being branded as an “anti,” I must say that I am waiting for better proofs of those views than those I have met with at present. Even if disinfection be rated at a minimum of utility, *quâ* prevention, there still remain two advantages to be gained by its use. In the homes of the poorer classes it secures a subsequent cleansing, which would not, in all probability, take place unless disinfection had been done, and, further, it impresses on the minds of the public the view of the sanitary authority that the disease is not one to be treated with a careless indifference, either as regards the patient or the public generally.

The last sentence leads naturally to a consideration of one item in the scheme for the prevention of the disease to which no reference was made—the omission was intentional—when detailing the machinery at the disposal of the medical officer of health. The item to which I wish now to refer is the education of public opinion.

It should be the aim of all members of a public health staff to impress upon the public that it is their duty to help in the

limitation of the spread of the disease. It should be made plain to parents that if they suspect a child to be going to have an attack of the disease they should not send the child to school, both for the sake of the child and for that of the public. The duty of at once reporting the case to the school teacher requires to be driven home, as also the obligation, both legal and moral, of preventing persons who are not members of the family from coming into contact with the patient, and of giving their other children an off-chance of escaping an attack by keeping them away from the patient—if possible. They will need to be advised, in some cases very strongly urged, to seek medical advice, if that be not already provided. The dangers of delay must be pointed out—although such duty is not strictly part of the work of prevention of the spread of the disease—as also that of exposing the patient to chills. The result of successful teaching upon such points will be made manifest in a reduced fatality and lessened frequency of sequelæ, such as tuberculosis.

I have endeavoured in the foregoing paragraphs to sketch out the lines on which I should wish to carry on the work of prevention of the spread of measles. Unfortunately, for various reasons, the scheme actually in operation falls far short of my ideal, which is to obtain the earliest possible information of “first cases,” and to surround the infected families with a “safety zone.” Such procedure will be most successful if diligently employed during inter-epidemic periods, and if special vigilance be exercised at dates when, according to past experience, epidemic outbursts may be expected. Nevertheless, I believe that a measure of success has attended the imperfect system which has been employed.*

IV.—By E. W. GOODALL, M.D.

The problem of the control of measles presents itself to me in a guise quite different from that in which it comes before medical officers of schools and medical officers of health. That portion of the Eastern Fever Hospital which is allocated to patients consists of a number of blocks of two wards each, containing from twelve to twenty beds apiece. The majority of the patients are children under ten years of age, who are

* Statistics in proof, or otherwise, of any success of the scheme cannot be brought forward until after the publication of the ages of the population as determined at the census of 1911.

suffering from scarlet fever or diphtheria, but there are also wards for measles cases, of which there are often a considerable number under treatment. My endeavour, therefore, is directed to preventing measles from being introduced into the scarlet fever and diphtheria wards (*a*) from outside the hospital, and (*b*) from the measles wards. Now, in respect of the latter question, *i. e.* the prevention of the conveyance of the infection of measles from the measles wards to the scarlet fever and diphtheria wards, I have no trouble. I find that measles does not spread from one ward to the other, even when one of two wards of one block is occupied by measles cases. Of course the usual simple precautions against the spread of infection are taken by those members of the staff who are obliged to go from one ward to another. But the infection of measles is not readily conveyed by third persons or infected articles, and is not spread for any long distance through the air. Moreover, it very quickly dies. Hence elaborate disinfection after measles is unnecessary.

The other question, however, (*a*), namely, the prevention of the entry of measles from outside the hospital into the scarlet fever and diphtheria wards, gives me some trouble. It is well known that some of the early symptoms of measles simulate scarlet fever on the one hand and diphtheria on the other, and if care is not exercised cases of measles will be sent into the scarlet fever and diphtheria wards as cases of those diseases. But in such cases the presence of Koplik's spots is of immense use in diagnosis; and I have frequently known a case of measles sent in the early stage to the hospital as a case of scarlet fever or diphtheria to be detected by the presence of these spots and sent to the proper ward, and thus the almost certain introduction of the disease into a scarlet fever or diphtheria ward has been prevented. But unfortunately measles may be, and is, introduced into these wards in a manner which cannot be avoided. A patient actually the subject of scarlet fever or diphtheria may, without the knowledge of anyone, have been infected with measles before admission to hospital and may develop the disease several days after admission. In a few instances the disease may be prevented from spreading to other patients by its early recognition (again, chiefly by the aid of Koplik's spots), and by the prompt removal of the patient. But more often the disease will spread to some of the other patients. When a ward is infected by measles my practice is as follows: The children are kept in bed; careful look-out is kept for the early symptoms

of measles (especially coughing and sneezing, Koplik's spots, and a rise of temperature). Directly any of these symptoms occur the patient is removed from the ward and the bedding is sent to the laundry. By that procedure the number of cases may be limited to a first batch, even though there may be a considerable number of children in the ward without a history of a previous attack of measles. Further, the ward is put in quarantine for twenty-one days from the removal of the last case of measles; no patient is discharged to his home or sent to the convalescent hospital during that period, nor is any new patient admitted. I make the quarantine period one of twenty-one days, because I have on several occasions known the incubation period be of from sixteen to twenty days' duration at the least. I have several times known a child who was said to have had measles previously catch measles in the hospital, so that I do not pay any attention to the history. I believe that second attacks of measles are of extreme rarity, and have only once in the whole of my experience had under my care a patient who suffered to my certain knowledge from two attacks of measles.

V.—By C. J. THOMAS, M.B., B.S.

In dealing with health problems amongst that section of the population whose children attend elementary schools, there is no situation which appears so hopeless to the school medical officer of an urban area as that in which he is face to face with an epidemic of measles on a large scale. He has to toil unceasingly with a gigantic task, well knowing that with all his strenuous efforts he can do little to abate the storm. If he considered only his personal comfort he would advise his authority to close the schools for a long period and take a holiday himself far from the madding problem. This vigorous action would be free from all danger to himself and would be applauded by the multitude. It speaks volumes for his courage and devotion to duty that he almost invariably rejects this easy solution. I know of no school medical officer of large experience who believes that in a crowded urban area by thus abandoning the tiller and leaving the storm to work its will anything but harm can result. The history of measles epidemics proves that given a sufficiently unprotected population measles will spread whether there be schools or whether there be none.

The existence of schools and compulsory attendance thereat gives the hygienist the only conceivable means at present of

watching the progress of an epidemic, of controlling it ever so slightly here and there, and of making the attempt—the only one of any value in my opinion in measles—to save life by being placed in possession of the knowledge of the homes in which measles has appeared. I believe that through school influence and through this particular information which can alone be obtained through the school organisation, much can be done, not indeed to arrest the spread of measles or to postpone to any useful extent the age of attack, but to bring forces to play in the way of individual advice and help by home visiting which will result in saving of individual lives and reduction of mortality. I believe that much has already been done and that more can be done in this way.

Dr. Kerr has referred during this discussion to my work in Woolwich in investigating the behaviour of measles in schools. I ought to take this opportunity of explaining that it was Dr. Kerr himself who mapped out the scope of the investigation, who put every facility in my way and who, in conjunction with Dr. Sidney Davis, the medical officer of health of Woolwich, in effect should have whatever credit is due for the results of that inquiry. The scope of the inquiry, which took five years to complete, was the investigation in relation to school of every case of measles occurring in the borough. Assistance was afforded by the sanitary inspectors of the borough and of the London County Council, by the whole staff of school attendance officers, and by teachers. The results of the inquiry laid down the lines on which the present regulations regarding exclusion from schools on account of measles are based.

In order to have a means of comparison of methods the borough was divided into two halves, in one of which vigorous closure was carried out; in the other closure was not adopted, but in all cases action in the homes was taken on the appearance of measles.

The measles history of every child was obtained, and every absence, for whatever cause, was investigated so that no cases were missed.

It soon became apparent that in boys' and girls' departments measles never by any chance spread, and that measles was confined so far as school spread was concerned to children in infant departments. As a result of this the present practice of allowing children from homes in which measles had appeared to attend senior departments was adopted.

It became clear also that a certain amount of postponement of attacks could be brought about by class closure provided

that closure took place before any secondary cases occurred, or, as it was expressed, before the occurrence of the first crop; closure after secondary cases arose produced no effect. The method of exclusion of unprotected children is still carried out whenever it is possible to get sufficiently early knowledge of the first case. But the question arises, what is the term of the postponement and is it worth while. My opinion is that given a sufficiently unprotected class, that is, a class of children whose unprotected members amount to nearly 40 per cent., that measles will recur again and again at short intervals until the percentage of unprotected drops to below the margin at which spread of measles occurs in schools. In the Woolwich schools it was found that the net result of closure of schools was very small; where successful closure took place, measles tended to break out again and again, some classes having to close as many times as thrice in six months.

I doubt whether—given the proportion of susceptible cases in which measles can spread—anything more than a six months' postponement of the attack can be obtained. Is this worth while? I am of opinion that it is not. Against the slight postponement of attack is to be placed the fact that when closure occurs all knowledge of secondary cases is lost, and it is not until the school reopens that the extent to which measles has spread in the interval can be ascertained. While in those schools which remain open absences can be visited and skilled help given in cases which prove to be measles, in cases where school is closed the only knowledge that comes to hand in the interval is in the death returns. It is important to note, in point of fact, that though as a result of attention to the homes in which measles appeared a reduction of measles mortality took place in the Borough of Woolwich in the five years from '67 to '24 per 1000—a far greater reduction than in the rest of London during the same time—it was reported by Dr. Davis that *the reduction in the closure district was less than that in the non-closure district.*

In this connection a most important set of comparative figures of mortality given by Dr. Butler in a recent communication to the Epidemiological Section of the Royal Society of Medicine is to be taken into account.

Dr. Butler's knowledge of these cases in Willesden was entirely obtained through school notification, and I cannot but believe that the remarkable saving of life exhibited was due to his strenuous efforts to combat mortality in the homes of known cases, and is a striking example of the value which accrues from

Comparative Case Mortality of Measles at ages in Aberdeen and Willesden. (Dr. Butler.)

Age-periods.	Case mortality.	
	Aberdeen.	Willesden.
0— . .	13·9	2·8
1— . .	10·0	5·0
2— . .	3·4	3·0
3— . .	1·6	1·5
0-4 . .	6·5	3·0
4— . .	·9	0·2
5 and upwards	·5	0·3

the school organisation. Were it not for the existence of the latter he would not have been in the position to make any attempt at control of the fatality rate.

Dr. Dudfield earlier in this discussion quoted some remarks made by me upon the occasion of Dr. Butler's reading of his invaluable paper above mentioned. He quotes me as saying that I was not at all convinced that the public elementary schools played such an evil part in measles as was generally attributed to them, and that later I described the aggregation of susceptible children in the schools as the sweeping into little heaps of the gunpowder representing such children; naturally when a child attends a school in an infectious state the little heaps will touch off.

These two remarks Dr. Dudfield thinks contradictory. They are, however, to my mind not so. The latter remarks were part of an attempt to contrast the state of a susceptible child population in an urban area in the absence of schools with that in the presence of schools. If every child susceptible to measles were represented by a grain of gunpowder, if there were no school attendance, the condition would be such that at certain periods in which susceptibility was high, the grains would be pretty evenly distributed over the area. What would happen when the infection was brought into the area would be just what would happen when a lighted match were applied to the edge of a plate evenly sprinkled with gunpowder—a sheet of flame would spread over the whole area. The metaphor of grains of gunpowder, however, is not a complete one; a better would be one which represented such children as explosive molecules with a certain amplitude of vibration; in the absence of orderly school attendance much more indiscriminate mixing of children takes place, with the result that the opportunities of contributing to the spread of disease are in some ways increased.

With school attendance, however, a system of order is

brought into play : the children each day take their appointed place in school, the amplitude of vibration of the molecules is very considerably limited, and each school forms a community isolated to a very great extent from the communities represented by other schools.

This segregation of practically all the children who otherwise could roam about into isolated communities for the greater part of the day must, of course, modify the spread of measles to a great extent, and I do not think sufficient stress has been laid upon this influence of school attendance in segregating the children of towns into distinct communities.

Instead of a sheet of flame passing over the area what one gets is a series of explosions, with a very definite latent period between the explosion in one heap and that of its next neighbour.

This, in fact, can be studied in any great outbreak of measles in London ; a definite latent period can be traced between the attack upon one school and the next so that measles takes about three months to advance two miles, and there is nothing illogical in supposing that the segregation of children into communities to some extent modifies the progress of the disease, and is not on the whole an evil thing.

In this respect the influence of holidays is to be considered. To the medical officer of a residential school the influence of holidays upon the spread of measles is of great importance. To him measles is the result of holidays ; if he can get over the first three anxious weeks after the holiday he knows he is safe. To him holidays are the cause of measles in his school.

In elementary schools to my mind much the same thing occurs ; during a long term it is often seen that measles begins to fall before the holidays begin ; after the holidays it rises again. The reason which occurs to me for this is that during the holidays the segregation into communities is largely broken down, visits to a distance take place, and a series of centres of spread occur at a distance from the orderly edge of measles progress during school term as a result of the temporary loosening of the grip which school attendance has upon the child population during term time.

The question, however, is largely an academic one ; we must have schools in a civilised community, and the fact that it is from schools alone that any information as to the actual incidence of disease can be obtained, makes it to my mind of great importance that they should be kept open during an outbreak of measles, inasmuch as it is only by this means that any effect upon fatality can be produced.

I do not believe that raising of the age of attendance would have a beneficial effect. Indeed the comparison of mortality figures of Scotch towns (where the lower limit of school attendance is higher) with those of English schools shows, if anything, that raising the age would increase mortality for measles.

Notification of measles would be invaluable if only all cases were seen by a doctor; the facts that it is only in a minority of cases that a doctor is called in and that it is precisely in those classes where help is most needed that the doctor's aid is never sought render notification on the lines of other infectious diseases at present useless.

If a complete co-ordination of all agencies controlling disease existed, it seems to me that much more could be done.

At present in London we have innumerable hospitals entirely unrelated to the public health service, in the case of many of which the attitude of the authorities in charge is one of entire indifference to the public health service, a large number of dispensaries and nursing associations; a growing number of school treatment and minor ailment centres, new dispensaries dealing only with tuberculosis, private practitioners, medical officers of health, sanitary inspectors, school nurses, health visitors, care committees and other agencies too numerous to mention. Is it too much to hope that some day, perhaps through the influence of the Insurance Act, when its funds will have accumulated sufficiently to extend operations to dependents, a condition of things will be brought about whereby this welter of unrelated effort will be brought into co-operation, and a system will be evolved whereby skilled diagnosis and necessary help will be placed within easy reach of every household, however poor? In this way alone does it seem to me that the utmost reduction that is possible will be effected in measles fatality.

Meanwhile school notification is alone possible and practicable as a source of knowledge of the incidence of measles, and I should like to see it enacted that every parent should forthwith notify to the school the apparent cause of the absence of a child liable to school attendance.

I would sum up my views upon the control of measles under the following heads:

(1) That very little can be done in urban areas to arrest the spread of measles or to reduce the attack-rate.

(2) That much can be done, given knowledge of the cases by the medical officer of health through his health visitors in the way of reducing fatality in measles.

(3) That the only source, and at present the only practicable source of knowledge of cases is the school organisation.

(4) That therefore the continuance of this organisation is of the utmost importance in the control of the mortality, and that school closure interferes with this control.

Dr. ARMSTRONG (Wellington College) doubted whether it was possible to control the spread of measles, and even if it was possible whether it was desirable. Efforts at control only effected a postponement to a later age, and the quarantine regulations were the principal reason for the great increase of the disease at the public schools. The number of unprotected boys entering school had increased by at least 12 per cent. in the last twenty-five years. This meant more frequent and bigger epidemics. He believed that the view that measles was more fatal in early years was erroneous, and quoted from Dr. Chalmers' Glasgow tables (*Proc. Roy. Soc. Med.*), showing that the influence was rather environment than age, and that the disease was not especially fatal to children living under proper hygienic conditions. It was purely chimerical to hope to stamp out the disease, and he referred to Fiji, Iceland, Faroe Islands, and other places where the mortality was excessive after the reimportation of the disease to districts from which it had been absent for a long time. If we must have these outbreaks, which he considered to be largely due to our efforts to arrest them, he thought it incumbent on school authorities to provide efficient accommodation for their treatment under favourable hygienic conditions, the want of which was responsible for some of the fatal cases; for it must be remembered that there is a very considerable mortality-rate from measles in the public schools; though there is no record of what this is, it is probable that it is considerably higher than that in Dr. Chalmers' tables for children in the second quinquennium who lived in four-roomed houses in Glasgow. Probably in no school was accommodation provided giving the space per bed of 144 sq. ft. and 2000 cubic ft. air-space recommended by the Local Government Board.

Dr. ATTLEE said: During eight years' practice among boys at Eton College one or two points in this connection have impressed themselves upon me.

I believe that, on the whole, very little is gained by attempting to control the spread of measles in a school like Eton, for we have several times by good luck and prompt isolation been able to avert an epidemic, only to pay for it next year by

having double the number of cases. During the last thirteen years we have averaged about sixty cases a year. Probably about another ten get the disease at home during the holidays. The yearly entry of new boys is about 210, and according to my figures about 33 per cent. of these are unprotected by a previous attack. Practically all the unprotected boys who enter appear from these figures, then, to get the disease at some time during their school life. At any rate this seems a reasonable conclusion unless some of the cases are instances of second attacks.

Second attacks of measles must be, I am sure, of exceedingly rare occurrence. I have never seen measles twice in the same individual, and I can find only one man among those who have practised at Eton for a number of years who can recall an instance of a second attack. He has only seen one such case. We average about 1000 boys, and measles may almost be said to be perennial with us, so that surely some of us would have come across instances if they are as common as some people would have us suppose.

Most of our epidemics occur during the first three months of the year. Of 735 cases since 1900, 578 have been during the Lent half, 49 during the Summer half, and 108 during the Michaelmas half.

As to the value of disinfection we have no experience to guide us, for we always practise it and so cannot speak of the results of omitting it, but I am convinced that the branny desquamation, so feared by parents and home doctors, is harmless. We do not prolong the isolation period on account of its presence, and I have never been able to trace a case to a convalescent of this kind.

At Eton each boy has a separate room with the exception of about fifteen of the Scholars who sleep in cubicles. There are two or three sick rooms for every forty boys. In an epidemic the sick rooms are first filled and then each boy is nursed in his own room. I do not know whether it is on account of this plan that we get very few really bad cases, but it is a fact that complications are rare. In the last eight years there have been two deaths in 374 cases—a mortality of a little over .5 per cent. It would be interesting to compare these figures with those of schools in which patients are nursed in wards or dormitories.

Dr. GRIPPER could only state that his experience was practically *nil*, because in a fairly large school for orphan girls of ages ranging from eight to sixteen, he could not remember any epidemic for fifteen years at least. Only ordinary precautions

were taken to protect the incidence to the school when measles was prevalent in the neighbourhood.

Dr. PROCTER, speaking from memory, said that in twenty years' experience at St. John's School, Leatherhead, big epidemics of measles occurred about every five years.

An epidemic had just occurred during the early part of the present year ; there were then 84 cases. In the Easter Term of 1908 there were 85 cases, and in the two previous epidemics there were in each about 60 cases. All these epidemics occurred in the early part of the year. Only one boy had died at the School, and this boy did not die from measles, but contracted laryngeal diphtheria at the same time ; tracheotomy was performed, but the boy succumbed to broncho-pneumonia. Another boy also died after an operation at a nursing home in London for mastoid disease.

Dr. Procter also said that he considered that second attacks of true measles were very rare ; in spite of the very general belief among the laity that second attacks were common, he could not call to mind having seen a second attack, although patients constantly averred they had had measles two or three times.

He did not think that measles was easily carried, but that it was intensely infectious by direct contact, especially in the early stages before the rash, and for that reason in his experience any attempt to " control " the disease was likely to prove futile.

He said he had been impressed in a good many cases, which he had had the opportunity of carefully watching, with the fact that the rash had been delayed for a full seven days after the initial rise of temperature and feeling of illness. In some of these cases very high temperatures—in one case as high as 105° F.—had been noted two or three days before the rash appeared, and occasionally in these cases there was great amelioration of symptoms and fall of temperature just before the onset of the rash.

Dr. ZILLA SCRUBY said : I am afraid that I cannot say anything that will add to the interest of the present discussion. My experience with regard to measles outbreaks is at the present time in the elementary schools of Buckinghamshire. With regard to disinfection, we do not trouble about disinfection of school premises after measles, and we have no reason to think that this should be necessary. The question of school closure for measles is complicated by the fact that closure is often requested for purely financial reasons, to avoid loss of grant.

In the infant departments closure after the first case, *i.e.* before

the first crop of cases appear, is sometimes successful in delaying the epidemic ; but infection is generally re-introduced from some outside source during the next few months. Still, it is sometimes possible to defer an epidemic in this way from the winter to the summer months. In the elementary schools the question of the exclusion of unprotected children is also complicated by the unreliability of the measles history obtainable.

Dr. SWIFT had been in private practice since 1874, and had been connected with the Foundling Hospital since 1877. He had never found that anything will control an epidemic, due to the infection being communicated by the breath and by ejection of saliva from the glands of the mouth, and communicable during the incubation period, probably five or six days before the appearance of the rash, and being taken directly into the larynx of the patient infected, and even, he believed, into the eyes.

He thought closing schools a great mistake ; if a boarding school, and you send patients to their homes, probably they may be infected, and you start an epidemic in another place. In day schools also you keep the children at their homes, often in close and unhealthy houses, and they are not in such a good state of health to fight the complaint as if kept at school. He found that he got an epidemic at the Foundling about every fourth or fifth year. The children are from five to fifteen years of age, and generally out of 400 about 100 take it ; in the last epidemic there were 152 cases—seventy-six boys and seventy-six girls ; it was mild in type, and he only had about six with pneumonia and very few after-sequelæ ; there were no deaths. A large proportion of the children had had measles when in the country between the ages of one and five.

He had never seen measles occur *twice* in the same child.

He had seen cancrum oris once, but that was in the country, in a very unhealthy farm-house, about the year 1873. The case recovered, although there was a slough from the angle of the jaw to the mouth.

You *can control the mortality from* measles by proper treatment of those affected, and no disease requires more care. He had tried open windows and no poultices, but he had had the best results from warmth and poultices or antiphlogistine, which controls the broncho-pneumonia and laryngeal cough better than anything he knew.

He had often had temperatures of 104° and 105° F., but he never minded them as long as the pulse was good. Directly he found the pulse begin to go up he always extra specially

examined the lungs, applying antiphlogistine to whichever lung is affected, and if very blocked, started some oxygen inhalation.

As regards diet, it is best if children are very averse to take milk, to let them have boiled water freely for the first twenty-four hours, and then get them on to their milk by degrees, with broth rather than beef-tea. He never let them have fruit for the first few days, as it so often sets up troublesome diarrhœa.

He kept them in bed till the rash has disappeared—and it will often take eight to ten days before it quite fades—then in a warm room for another week.

He never carried out any special disinfection for measles, either to clothes or bedding. But the children have a warm bath with sanitas in it, or warm sponging.

Treatment consists of a mixture of ipecacuanha, potass. citratis, liq. ammon. acetat., tinct. cardam. co. and syrup.

He prefers never to give young children any tinct. camph. co. or opium in any form.

In the general nursing he is very particular to have the mouths washed out with glycerine and borax daily, the eyes bathed with boric lotion, and the ears washed and dried.

It is an extraordinary fact, but he had seen many puny small children after an attack of measles suddenly start to grow and develop as if they had thrown off some poison; in other words, it may be that the acute sepsis set up by the germ of measles destroys some other germ more or less latent in the system. So he is not sure whether it is wise on our part to try and stop an epidemic.

Dr. ELLISON thought it a little remarkable that there is such a divergence of opinion between the medical officers of health and the medical officers of schools as to the possibility of control of measles.

“For my own part, twenty-eight years’ practice at Eton has convinced me that control is impossible, at least in such a crowded community as a large school.

The question of the need for disinfection of patients before the termination of isolation was alluded to by a former speaker.

On this point I may say that we always insist on the carrying out of thorough methods of disinfection.

It is absolutely necessary in order to satisfy parents.

As to the possibility of a patient being twice attacked by measles, it may perhaps exist, but I have never come across such a case.

It may be worth mentioning that I have on two or three

occasions noticed malaise and febricula commencing at the period of *infection*, and lasting for a few days. This is of no practical interest as a danger signal, since such attacks are so common among schoolboys, and are very rarely precursors of measles.

One more point: a case was mentioned by Dr. Kerr of a girl, "Nellie," who infected other children three weeks after the commencement of her attack.

I should like to know whether in this case there was any cough, or discharge from ear or throat, or other complication at the time the infection was conveyed to others.

With regard to this case, and also to the statement by Dr. Goodall that he is accustomed to exact an isolation period of twenty-one days, I would mention that, in the school with which I am connected, we always observe the rule laid down in our code of one fortnight's isolation in all uncomplicated cases.

This often leads to protests on the part of parents and home doctors, but I have never yet heard of a case of infection having been conveyed to others after this period, which was substituted in our code for three weeks some fourteen years ago."

The PRESIDENT (Dr. SHELLY), proposed a hearty vote of thanks to those who had initiated and carried on the discussion, and said it had been one of the most interesting in the annals of the Association, and was not an easy one to summarise. "The control of measles" had been viewed from two standpoints—the control of measles in its endemic aspect as a national scourge, and the control of each epidemic outbreak of the disease. Obviously, if every avenue of infection could be stopped, no individual would contract measles. But such protection of each individual was admittedly impracticable. And, even were it possible to secure such complete protection for a time, for a generation or two, the eventual and inevitable introduction of the infection, or the not less possible re-evolution of the specific virus, would result in a catastrophe comparable only to such as has followed its implantation into a virgin soil like that afforded by the unfortunate inhabitants of Fiji. In other words, no such efforts for the protection of its individual members could be successful in securing a people's immunity. On the other hand, further and fuller extension of hygienic measures, which have made the measles of to-day a malady so much less serious than the disease which our forefathers knew, might (as it has done with typhus, *e.g.*) so reduce its virulence as to make it always a trivial complaint, or permit of the ready acceptance of inoculation, or possibly of "vaccination" against

it. As regards a measles epidemic, the large public and residential schools contrast with the elementary schools and with day schools generally.

The public school, as has been aptly said, represents a large family—all living at home. Both practise, more or less successfully, the same precautions against the admission and the dissemination of infection. But, while the new baby does not bring measles with him into the family, the new boy—and the boy newly returned after the holidays—frequently introduces it into the school. The precautions taken by parents and their medical advisers tend to protect the children of each home from infection: similarly, the child is again protected at his preparatory school. This results in a raising of the age at which he contracts the malady, and adds to the anxieties of the public school medical officer. This result was an inevitable accompaniment of the hygienic instruction of parents, and was foreseen and foretold long ago. Nor is it wholly regrettable. For not only is the mortality of measles greater among the very young, but—as Dr. Mumford has shown—the permanent effects of the disease on those who have suffered from and have survived it in early life are much more general and more marked than amongst those who contract measles at a later stage; so that this raising of the age of measles-infection stands for a distinct gain to national ability. Its economic drawbacks must apparently be accepted until such time as the public has been educated to believe that the healthy child living under good hygienic conditions may with advantage be encouraged to fulfil its measles-destiny as soon as possible after the age of seven or eight.

It seems to be generally admitted that second attacks of true measles in the same individual are of such extreme rarity that a single genuine attack may be regarded as conferring an immunity lasting throughout the ordinary school-age at all events.

The dictum of the Medical Officer to the Junior School of Christ's Hospital (comprising both boys and girls) was that a second attack in a child under thirteen was unknown. The practical difficulty which confronts the school medical officer is that of ascertaining that the reported attack of measles in earlier life was really one of morbilli. There appeared to be a general consensus of opinion to the effect that disinfection after an attack of, or after exposure to, measles is uncalled for—except as a *placebo*. With this, however, he was not prepared to agree. He had, indeed, always regarded the virus of

measles as one possessing but feeble resisting power, and quite effectively disposed of by exposure to fresh air and sunshine for a few hours. But was it the virus of measles only that called for disinfection? The measles' patient exhaled, sneezed, coughed, expectorated material which clung to and dried upon the objects in his neighbourhood. So far as the active principle (as yet unisolated) of the measles virus itself was concerned, this was probably of no great moment, for reasons just given. But it was disquieting to find how often and how consistently this material contained the pneumococcus. Again, it has been stated, on authority not yet controverted, that no child dies of measles without tubercle bacilli being demonstrable post-mortem. Both these are fairly resistant organisms: the infections to which they give rise may be both insidious and delayed in their development, and their association with some antecedent exposure to the infection of measles would be apt to escape attention. For these reasons he regarded the abrogation of the disinfection of fomites, etc., after measles as entailing a responsibility not justified in the present state of our knowledge of the subject. The complaints made in regard to the inadequate accommodation generally available for the treatment of a large measles outbreak in residential schools were only too well founded. Ample ventilation without draughts—which implied ample floor space—he believed to be essential. In this disease especially does overcrowding invite those mixed infections which furnish the graver class of cases, and lead to the development of the more virulent forms of infection. The problem involved was the more difficult because any large school in a full-term epidemic might be called up to ward at least 20 per cent. of its population; and if the epidemic began by several foci the admissions might occur in waves of large volume. There was one method of procedure, the principle of which was applicable to every outbreak, large or small, which should, he believed, always be followed. Nowadays, quite early in the epidemic, we could foretell within near limits the total accommodation likely to be required. It was not enough to be prepared to supply this. The plan to be followed was not to fill up one ward first, and then the second, and so on, as the cases came in; but to distribute the batch first admitted, two or three in a ward only, and in beds as far apart as might be; the succeeding batches of patients should be similarly sparsely distributed amongst the remaining wards in the sanatorium, until all these had been occupied in the same way. By that time, however, a large dormitory or other spacious accommoda-

tion should be cleared and ready for the reception of further admissions. When these had been distributed at intervals throughout the dormitory it might still be necessary to sprinkle fresh cases amongst the wards already occupied, never filling all the beds in any ward or dormitory if this could be avoided. By this plan, before all available beds were occupied, some of the first admitted patients would be able to get up, and some milder cases might be discharged. Thus, the pressure on each ward was equalised, to some extent at all events; and overcrowding of any ward with acute and serious cases, all in the same stage, could be sensibly relieved. This plan involved some additional trouble and some extra expense (for a larger nursing staff) from the very first. But it was a practical attempt, intelligent and helpful towards lessening the dangers attendant on an allowance of floor-space inadequate for properly nursing a large outbreak of measles.

Perhaps we could obtain further useful hints towards an ultimate control of measles by pushing our clinical observations still further. For instance, What *are* Koplik's spots? Do they in any way correspond to the "patches" observed in the diphtheritic throat? Will not someone, greatly daring, excise "a Koplik"—or, at least, examine scrapings from one, and enlighten us as to its bacteriological content and its true pathological significance? Again, why does the normal breast-fed infant show such a remarkable immunity to the disease, as a rule, though—almost always—freely exposed to the risk of infection from caressing brothers and sisters? The healthy breast-fed infant was not a vegetarian; its physiological income and expenditure were exquisitely balanced; its elimination of waste products was remarkably efficient; and, most significant of all, perhaps, was the alleged fact, that while, like the adult, its nasal mucus (above the ampullæ of the nostrils) was sterile, the bactericidal power of this mucus was greater than that of the adult. The virus of measles was, almost certainly, inhaled by way of the nasal passages, except in the case of mouth-breathers. In that situation it might secure a nidus and develop as a pure culture. By the time that it had spread, by way of the naso-pharynx, to the tracheal and bronchial mucous membrane, absorption of the pure virus from the primary, nasal, site of infection had already evoked a degree of somatic resistance; so that, despite the larger area of absorption provided by the trachea and bronchi, the net result was comparatively trivial and the case was a mild one. If the nasal mucous membrane was unhealthy, or if the virus

entered by the mouth, the infection was apt speedily to become a mixed one, and the symptoms might be more irregular and more severe. In cases of nasal obstruction there was practically no early absorption of a pure culture from the nasal mucous membrane, and no preliminary warning to rouse the forces of defence. The prodromal symptoms were irregular, the appearance of the eruption apt to be delayed. But, as the mixed infection invaded trachea and bronchi, there occurred a sudden absorption of more virulent toxins from a larger area, with the attendant high fever, serious bronchopneumonic symptoms, and a rash more marked and often abnormal in character. That was the interpretation he put upon the clinical observation of cases treated after the usual routine methods; and (he believed) it was corroborated by a series of twenty-four cases recently treated by merely irrigating the nares with a weak, bland antiseptic solution in the first case, and merely spraying the naso-pharynx with a similar solution in the next case, and so on, alternately. In the nasally irrigated, the prodromal symptoms subsided and the rash was delayed by five to seven days; then it appeared rapidly and generally, blotched and raised, with severe cough and very marked bronchitic symptoms. In the others, the rash was relatively slight and not delayed; there were a few cases of moderate laryngeal cough, lasting only a day or two, and practically no bronchial catarrh; these patients remained quite cheerful and lively and with good appetites throughout. The twenty-fifth case, a young adult with well-marked prodromal symptoms, was treated by both nasal irrigation and pharyngeal spray for a week. The pyrexia (maximum, 102° F.) lasted for thirty-six hours only, and no rash or cough or bronchial catarrh developed. No one would seriously venture to build dogmatic pronouncements on a series of observations so small in number in connection with a malady of this kind, but he thought that they did at least suggest a line of investigation worth consideration if not pursuit. Personally, he inclined to sum up our relation to the control of measles somewhat thus: Improve sanitation, correct overcrowding, protect the very young from infection so far as possible—especially if their environment be unhygienic, until the milder, unmixed infection breeds true (as typhus now does in this country); then, encourage repeated small epidemics at the age of about seven to eight years, until the public is educated to accept inoculation—or “vaccination.”

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